Verification of Loop Diagnostics

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Many different techniques have been used to characterize the plasma in the solar corona: density-sensitive spectral line ratios are used to infer the density, the evolution of coronal structures in different passbands is used to infer the temperature evolution, and the simultaneous intensities measured in multiple passbands are used to determine the emission measure. All these analysis techniques assume that the intensity of the structures can be isolated through background subtraction. In this paper, we use simulated observations from a 3D hydrodynamic simulation of a coronal active region to verify these diagnostics. The density and temperature from the simulation are used to generate images in several passbands and spectral lines. We identify loop structures in the simulated images and calculate the loop background. We then determine the density, temperature and emission measure distribution as a function of time from the observations and compare with the true temperature and density of the loop. We find that the overall characteristics of the temperature, density, and emission measure are recovered by the analysis methods, but the details of the true temperature and density are not. For instance, the emission measure curves calculated from the simulated observations are much broader than the true emission measure distribution, though the average temperature evolution is similar. These differences are due, in part, to inadequate background subtraction, but also indicate a limitation of the analysis methods.